REMARKS

The Office Action has withdrawn Claims 1-66 from consideration. In addition, the Office Action has allowed Claims 68-98. However, it has rejected Claims 67 and 90-96 under 35 U.S.C. §102(e), as defining subject matter which is allegedly anticipated by the teachings in U.S. Patent No. 6,471,936 to Chen et al. ("Chen et al. I").

Applicants are submitting the following comments, which are deemed to place the present case in condition for allowance. Favorable action is respectfully requested.

Before addressing the merits of the rejection, Applicants have amended Claim 67 to correct a typographical error therein. Applicants have corrected the error therein by replacing "composed" with "comprised". In addition, inasmuch as claims 1-66 have been withdrawn from consideration, and inasmuch as claim 90-96 are dependent upon claims withdrawn from consideration, Applicants have amended claims 90-96 by specifically reciting therein subject matter in claims 1, 2, 3, 7, 11, 15, 18, respectively, upon which they depend.

No new matter is added to the application. Moreover, these amendments to the claim do not narrow the scope thereof.

Pursuant to the rejection of Claims 67 and 90-96 under 35 U.S.C. §102 (e), the Office Action cites Chen et al. I.

The subject matter of Claim 67 is directed to a solid substance comprised by more than one half by weight of hollow carbon nanotubes having walls consisting essentially of two layers of carbon atoms. Claims 90-96 are directed to fullerene material predominately comprised of double walled carbon nanotubes produced by the method of Claim 1, 2, 3, 7, 11, 15 and 18, respectively. This subject matter is not disclosed or described in Chen et al. I.

Chen, et al. I disclose various types of carbon nanotubes, single walled nanotubes and multi-walled nanotubes. However, Chen, et al. I do not teach, disclose or suggest double walled nanotubes, the subject matter contained in the rejected claims. A review of Chen et al. I clearly establishes that there is no mention therein of double walled nanotubes.

The Office Action refers to column 4, lines 25-35 and Figures 1b, 1d, 2b and 2d of Chen et al. I. However, the passage in Column 4 does not teach, disclose or suggest double walled nanotubes. Moreover, neither Figures 1b, 2b, 1d nor 2d depict double walled nanotubes. Figures 1b and 2b depict nanotubes having several layers; not just two layers, as would be the case if double walled nanotubes were formed. Moreover, Figures 1d and 2d depict stacked truncated nanotubes, but these are also multilayered. Unlike the present invention, Chen et al. I do not teach or disclose nanotubes wherein the number of carbon layers are controlled, so that the product formed thereby contain substantially double walled nanotubes. As recognized by the United States Patent and Trademark Office in an earlier Office Action, the conditions of the formation of the nanotubes in Chen et al. I is quite different that from the present invention. As a result, Chen et al. I do not produce DWNT's.

The Office Action acknowledges that Chen et al. I disclose multi-walled nanotubes. It however, alleges, that the dictionary definition of multiple is "having relating to, or consisting of more than one individual, element, part or other component". It concludes that based on the definition of multi, multi-walled referred to in Chen et al. I includes double walled.

The Office Action is completely ignoring the teachings in Chen et al. I. A review of Chen et al. I clearly establishes that the multi-walled nanotubes referred to therein contain more than two walls. In fact, as indicated hereinabove, the Figures therein do not depict any double walled nanotubes. Further, there is no mention in the text of Chen et al. I of any double walled

nanotubes. Thus, it is a mere assumption by the United States Patent and Trademark Office that Chen et al. I disclose multi-walled nanotubes.

Moreover, contrary to the allegations in the Office Action, the dictionary definition of multi is "more than two". Enclosed herewith is a copy of the dictionary definition of multi, which multi is defined as "more than two". (See attached).

Thus, in view of the definition of "multi" it cannot be said that multi-walled, as described in Chen et al. I includes double walled nanotubes. Thus, based on this definition, Chen et al. I do not teach, disclose or suggest double-walled nanotubes.

However, assuming pro arguendo that multi includes the definition of more than "one" and "more than two", it also follows that based upon the logic of the United States Patent and Trademark Office, it cannot be said that multi-walled nanotubes, as described in the Chen et al. I includes double walled. According to this interpretation, multi-walled may or may not include double-walled. Even following this interpretation, the claims are not anticipate by the teachings in Chen et al. I. Case law has held that anticipation requires identity of invention. Since there is no specific teachings of double walled nanotubes in Chen et al. I, the United States Patent and Trademark Office must be alleging that the teachings of double walled nanotubes in Chen et al. I is inherent. However, in order to find anticipation by inherency, the prior art must necessarily include the claimed limitation it anticipates. See, In re King, 801F2d 1324, 1326, 23 USPO 136, 138 (Fed Cir 1986). See also, Schering Corp. v. Genesa Pharmaceuticals, Inc. 339 F3d 1373, 1377-1378 (Fed Cir 2003). But, based on the analysis, since multi is defined as more than one or two, it does not necessarily follow that multi-walled, as used in Chen et al. I includes double walled, thus, the United States Patent and Trademark Office has not made out a prima facie case of anticipation.

Moreover, based on the teachings in Chen et al. I it is evident that the multi-walled nanotubes therein do not include double walled nanotubes.

Chen et al. I do not teach how to selectively synthesize DWNTs. Chen et al. I describe in (Example 10 and Column 4, Lines 25-68) and in the journal article referenced in Chen et al. I, namely, P. Chen et al., Carbon 35, 10-11, 1495 (1997), the synthesis of essentially thick Multi-Walled Nanotubes (MWNTs) and nanofibers with the average outer diameter 15-20 nm, in the temperature range 600-700 C and with a catalyst based on nickel metal. No double-walled nanotube syntheses have been reported by Chen et al. I.

Moreover, DWNTS cannot in principle form under the synthesis conditions employed in Chen et al. I or described in the referenced article. Formation of thin-walled nanotubes, particularly DWNTs, requires very special conditions that are dictated by the mechanism of metal catalyst action. The process temperature, the type of metal and size of catalyst particles, the value of carbon diffusivity in the metal, the type and reactivity of carbon feedback are major factors determining the possibility of DWNT formation. These factors are interdependent, and only certain combinations of parameters could give rise to DWNT formation. In particular, the 600-700 C temperature used by Chen et al. I is too low for nickel-based catalysts and carbon monoxide or methane gasses as the feedstock to form DWNTs. For nickel particles that are sufficiently small for DWNT formation, the necessary rates of carbon feedstock decomposition at the particle surface and of carbon diffusion through the particles cannot be achieved in this temperature range. Only MWNTs, amorphous carbon and graphitic coatings on metal particles are generated at these temperatures, while DWNT formation requires much higher temperatures and catalysts with higher carbon diffusivity and lower activity in dehydrogenation and

decomposition of a carbon feedstock. These conditions are not met in the Chen et al. I, which means that DWNTS cannot be made by the process described in Chen et al. I.

Moreover, to determine whether DWNTs catalysts could be obtained under the conditions employed in Chen et al. I, the conditions described in Chen et al. I were substantially repeated by one of the inventors. No DWNTS were found to be formed under these conditions, despite focused search for same in the products produced.

Anticipation requires that the cited reference have identity of invention with the claimed subject matter. Since Chen et al. I does not teach or disclose products wherein the product is comprised essentially or substantially of double walled nanotubes, Chen et al. I does not anticipate the subject matter of Claims 67 and 90-96. This rejection of Claims 67 and 90-96 under 35 U.S.C. §102(e) is thus obviated. Withdrawal thereof is respectfully requested.

Therefore, for the reasons given herein, the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

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mull·ite \'məl-,īt\ *n* [*Mull*, island of the Inner Hebrides] (1924) : a mineral $Al_6Si_2O_{13}$ or $3Al_2O_3{\cdot}2SiO_2$ that is an orthorhombic silicate of aluminum resistant to corrosion and heat and used as a refractory

multi- *comb form* [ME, fr. MF or L; MF, fr. L, fr. *multus* much, many — more at MELIORATE] **1** : many : multiple : much ⟨*multi*valent⟩ ⟨*multi*lateral⟩ **2** : more than two ⟨*multi*para⟩ **3** : many times over ⟨*multi*millionaire⟩

multi-age
multi-agen-cy
multi-ap-er-ture
multi-ap-proach
multi-armed
multi-at-om
multi-au-thored
multi-ax-i-al
multi-band
multi-bar-rel
multi-bar-reled
multi-bil-lion
multi-bil-lion-aire
multi-blad-ed
multi-branched
multi-build-ing
multi-cam-pus
multi-car
multi-car-bon
multi-caus-al
multi-cell
multi-celled
multi-cel-lu-lar
multi-cel-lu-lar-i-ty
multi-cen-ter
multi-chain
multi-cham-bered
multi-chan-nel
multi-char-ac-ter
multi-city
multi-coat-ed
multi-col-or
multi-col-ored
multi-col-umn
multi-com-po-nent
multi-con-duc-tor
multi-copy
multi-coun-ty
multi-crest-ed
multi-cul-tur-al
multi-cul-tur-al-ism
multi-cu-rie
multi-cur-ren-cy
multi-de-noli-i-na-tion-al
multi-den-tate
multi-di-a-lec-tal
multi-di-men-sion-al
multi-di-men-sion-al-i-ty
multi-di-rec-tion-al
multi-dis-ci-plin-ary
multi-dis-ci-pline
multi-di-vi-sion-al
multi-do-main
multi-dwell-ing
multi-elec-trode
multi-elec-tron-ic
multi-el-e-ment
multi-en-gine
multi-eth-nic
multi-fac-et-ed
multi-fac-tion-al
multi-fam-i-ly
multi-fil-a-ment
multi-flash
multi-flu-id
multi-fo-cal
multi-fre-quen-cy
multi-fu-el
multi-func-tion
multi-func-tion-al
multi-gen-er-a-tion-al
multi-gen-ic
multi-grade
multi-grid
multi-group
multi-hand-i-capped
multi-head-ed
multi-hos-pi-tal
multi-hued
multi-hull
multi-in-dus-try
multi-in-sti-tu-tion-al
multi-lane
multi-laned
multi-lev-el
multi-lev-eled
multi-lobed
multi-manned
multi-me-dia
multi-mega-ton
multi-mega-watt
multi-mem-ber
multi-me-tal-lic
multi-me-ter
multi-mil-len-ni-al
multi-mil-lion
multi-mil-lion-aire
multi-mode
multi-mo-lec-u-lar
multi-mo-tor
multi-na-tion
multi-nu-cle-ar
multi-nu-cle-ate
multi-nu-cle-at-ed
multi-or-gas-mic
multi-pa-ram-e-ter
multi-part
multi-par-ti-cle
multi-par-ty
multi-path
multi-pho-ton
multi-pi-on
multi-pis-ton
multi-plane
multi-plant
multi-plot
multi-pole
multi-pow-er
multi-prob-lem
multi-prod-uct
multi-pur-pose
multi-ra-cial
multi-ra-cial-ism
multi-range
multi-roomed
multi-sea-son
multi-ser-vice
multi-sid-ed
multi-site
multi-size
multi-skilled
multi-source
multi-spec-tral
multi-speed
multi-step
multi-sto-ried
multi-sto-ry
multi-syl-lab-ic
multi-sys-tem
multi-tal-ent-ed
multi-tiered
multi-ton
multi-tone
multi-tow-ered
multi-track
multi-union
multi-unit
multi-use
multi-vi-ta-min
multi-vol-ume
multi-vol-umed
multi-wall
multi-war-head
multi-wave-length
multi-year

multi-en-zyme \,məl-tē-'en-,zīm, -,tī-\ *adj* (1961) : composed of or involving two or more enzymes or subunits similar to enzymes esp. when they have related functions in a biosynthetic pathway ⟨~ complex⟩

multi-fac-to-ri-al \-fak-'tōr-ē-əl, -'tȯr-\ *adj* (1920) **1** : having characters or a mode of inheritance dependent on a number of genes at different loci **2** *or* **multi-fac-tor** \-'fak-tər\ : having, involving, or produced by a variety of elements or causes ⟨a ~ study⟩ ⟨a disease with a ~ etiology⟩ — **multi-fac-to-ri-al-ly** \-ē-ə-lē\ *adv*

multi-far-i-ous \,məl-tə-'far-ē-əs, -'fer-\ *adj* [L *multifarius*, fr. *multi-* + *-farius* (akin to *facere* to make, do) — more at DO] (1593) : having or occurring in great variety : DIVERSE — **multi-far-i-ous-ness** *n*

multi-flo-ra rose \,məl-tə-,flōr-ə-, -,flȯr-\ *n* [NL *multiflora*, lit., having many flowers] (1829) : a vigorous thorny rose (*Rosa multiflora*) with clusters of small flowers

multi-fold \'məl-tī-,fōld\ *adj* (1806) : MANY, NUMEROUS

multi-form \'məl-tī-,fȯrm\ *adj* [F *multiforme*, fr. L *multiformis*, fr. *multi-* + *-formis* -form] (1603) : having many forms or appearances — **multi-for-mi-ty** \,məl-tī-'fȯr-mət-ē\ *n*

multi-germ \'məl-tī-,jərm, -,tī-\ *adj* [prob. fr. *multi-* + *germinate*] (1950) : producing or being a fruit cluster capable of giving rise to several plants ⟨a ~ variety of sugar beet⟩

multi-lat-er-al \,məl-tī-'lat-ə-rəl, -,tī-, -'la-trəl\ *adj* (1696) **1** : having many sides **2** : involving or participated in by more than two nations or parties ⟨~ agreements⟩ — **multi-lat-er-al-ly** \-ē\ *adv*

multi-lay-ered \-'lā-ərd, -'le(-ə)rd\ *or* **multi-lay-er** \-'lā-ər, -'le(-ə)r\ *adj* (1931) : having or involving several distinct layers, strata, or levels ⟨~ epidermis⟩ ⟨~ tropical rain forest⟩ ⟨~ personality⟩

multi-lin-gual \-'liŋ-g(yə-)wəl\ *adj* (1838) **1** : of, containing, or expressed in several languages ⟨a ~ sign⟩ ⟨~ dictionaries⟩ **2** : using or able to use several languages ⟨~ translators⟩ — **multi-lin-gual-ism** \-g(yə-)wə-,liz-əm\ *n* — **multi-lin-gual-ly** \-g(yə-)wə-lē\ *adv*

multi-mod-al \-'mōd-ᵊl\ *adj* (1902) : having or involving several modes, modalities, or maxima ⟨~ distributions⟩ ⟨~ responses⟩

multi-na-tion-al \-'nash-nəl, -ən-ᵊl\ *adj* (1926) **1** : of or relating to more than two nationalities ⟨a ~ society⟩ **2** *a* : of, relating to, or involving more than two nations ⟨a ~ alliance⟩ *b* : having divisions in more than two countries ⟨a ~ corporation⟩ — **multinational** *n*

multi-no-mi-al \-'nō-mē-əl\ *n* [*multi-* + *-nomial* (as in *binomial*)] (1674) : a mathematical expression that consists of the sum of several terms : POLYNOMIAL — **multinomial** *adj*

mul·tip-a-rous \,məl-'tip-ə-rəs\ *adj* [NL *multiparus*, fr. *multi-* + L *-parus* -parous] (1646) **1** : producing many or more than one at a birth **2** : having experienced one or more previous parturitions

mul·ti-par-tite \,məl-ti-'pär-,tīt\ *adj* [L *multipartitus*, fr. *multi-* + *partitus*, pp. of *partire* to divide, fr. *part-*, *pars* part] (ca. 1721) **1** : divided into several or many parts **2** : having numerous members or signatories ⟨a ~ treaty⟩

mul·ti-phase \'məl-tī-,fāz\ *adj* (ca. 1890) : having various phases; *esp* : POLYPHASE

mul·ti-pha-sic \,məl-tī-'fā-zik, -,tī-\ *adj* (1940) : having various phases or elements ⟨a ~ test⟩

¹multiple \'məl-tə-pəl\ *adj* [F, fr. L *multiplex*, fr. *multi-* + *-plex* -fold — more at -FOLD] (1647) **1** : consisting of, including, or involving more than one ⟨~ births⟩ **2** : MANY, MANIFOLD ⟨~ achievements⟩ **3** : shared by many ⟨~ ownership⟩ **4** : having numerous aspects or functions : VARIOUS **5** *a* : being a circuit with a number of conductors in parallel *b* : being a group of terminals which make a circuit available at a number of points **6** : formed by coalescence of the ripening ovaries of several flowers ⟨a ~ fruit⟩

²multiple *n* (1685) **1** *a* : the product of a quantity by an integer ⟨35 is a ~ of 7⟩ *b* : something in units of more than one or two **2** : PARALLEL 4b

multiple allele *n* (1938) : any of more than two allelic factors located at one chromosomal locus

multiple-choice *adj* (1927) **1** : having several answers from which one is to be chosen ⟨a ~ question⟩ **2** : composed of multiple-choice questions ⟨a ~ test⟩

multiple factor *n* (1915) : one of a group of nonallelic genes that according to the multiple-factor hypothesis control various quantitative hereditary characters

multiple myeloma *n* (1897) : a disease of bone marrow that is characterized by the presence of numerous myelomas in various bones of the body

multiple personality *n* (1901) : an hysterical neurosis in which the personality becomes dissociated into two or more distinct but complex and socially and behaviorally integrated parts each of which becomes dominant and controls behavior from time to time to the exclusion of the others — compare SPLIT PERSONALITY

multiple regression *n* (1924) : regression in which one variable is estimated by the use of more than one other variable

multiple sclerosis *n* (1885) : a diseased condition marked by patches of hardened tissue in the brain or the spinal cord and associated esp. with partial or complete paralysis and jerking muscle tremor

multiple star *n* (1850) : several stars in close proximity that appear to form a single system

multiple store *n, chiefly Brit* (1929) : CHAIN STORE

mul·ti-plet \'məl-tə-plət\ *n* (1922) **1** : a spectrum line having several components **2** : a group of elementary particles that are different in charge but similar in other properties (as mass)

mul·ti-ple-valued \,məl-tə-pəl-'val-(,)yüd\ *adj* (1882) : having at least one and sometimes more of the values of the range associated with each value of the domain ⟨a ~ function⟩ — compare SINGLE-VALUED

multiple voting *n* (ca. 1902) : illegal voting by one person in two or more constituencies

¹mul·ti-plex \'məl-tə-,pleks\ *adj* [L] (1557) **1** : MANY, MULTIPLE **2** : being or relating to a system of transmitting several messages simultaneously on the same circuit or channel

²multiplex *vt* (1907) : to send (messages or signals) by a multiplex system. ~ *vi* : to multiplex messages or signals — **mul·ti-plex-er** *or* **mul·ti-plex-or** \-,ər\ *n*

mul·ti-pli-cand \,məl-tə-pli-'kand\ *n* [L *multiplicandus*, gerundive of *multiplicare*] (1594) : the number that is to be multiplied by another

mul·ti-pli-ca-tion \,məl-tə-plə-'kā-shən\ *n* [ME *multiplicacioun*, fr. MF *multiplication*, fr. L *multiplication-*, *multiplicatio*, fr. *multiplicatus*, pp. of *multiplicare* to multiply] (14c) **1** : the act or process of multiplying : the state of being multiplied **2** *a* : a mathematical operation that at its simplest is an abbreviated process of adding an integer to itself a specified number of times and that is extended to other numbers in accordance with laws that are valid for integers *b* : any of various mathematical operations that are analogous in some way to multiplication of the real numbers but are defined for other or larger sets of elements (as complex numbers, vectors, matrices, or functions)

multiplication sign *n* (1907) : a symbol used to indicate multiplication: *a* : TIMES SIGN *b* : DOT 2b

mul·ti-pli-ca-tive \,məl-tə-'plik-ət-iv, 'məl-tə-plə-,kāt-\ *adj* (1653) **1** : tending or having the power to multiply **2** : of, relating to, or associated with a mathematical operation of multiplication ⟨the ~ property of 0 requires that $a{\cdot}0 = 0$ and $0{\cdot}a = 0$⟩ — **mul·ti-pli-ca-tive-ly** *adv*

multiplicative identity *n* (1958) : an identity element (as 1 in the group of rational numbers without 0) that in a given mathematical system leaves unchanged any element by which it is multiplied

multiplicative inverse *n* (1958) : an element of a mathematical set that when multiplied by a given element yields the identity element — called also *reciprocal*

mul·ti-plic-i-ty \,məl-tə-'plis-ət-ē\ *n, pl* **-ties** [ME, fr. MF *multiplicité*, fr. LL *multiplicitat-*, *multiplicitas*, fr. L *multiplic-*, *multiplex* multiple] (15c) **1** : the quality or state of being multiple or various **2** : a great number **3** : the number of times a root of an equation or zero of a function occurs when there is more than one root or zero ⟨the ~ of $x = 2$ for the equation $(x - 2)^3 = 0$ is 3⟩ **4** : the number of components in a system (as a multiplet or a group of energy levels)

mul·ti-pli-er \'məl-tə-,pli(-ə)r\ *n* (15c) : one that multiplies: as *a* : a number by which another number is multiplied *b* : an instrument or device for multiplying or intensifying some effect *c* : a key-operated machine or mechanism or circuit on a machine that multiplies figures and records the products

¹mul·ti-ply \'məl-tə-,plī\ *vb* **-plied; -ply·ing** [ME *multiplien*, fr. OF *multiplier*, fr. L *multiplicare*, fr. *multiplic-*, *multiplex* multiple] *vt* (13c) **1** : to increase in number esp. greatly or in multiples : AUGMENT **2** *a* : to find the product of by multiplication ⟨~ 7 and 8⟩ *b* : to use as a